JUST IN TIME MATH PROJECT AT UTSA

M. Shadaram, Associate Dean of Engineering, P.I.
B. Alger, Coordinator for Engineering Outreach
T. B. Morrow, Adjunct Professor, Presenter
Center for Excellence in Engineering Education
University of Texas at San Antonio
San Antonio, TX

Fourth Annual Meeting
National Engineering Mathematics Consortium

San Antonio, TX
June 12, 2012

About UTSA

- Established in 1969
- Fall 2011 Enrollment 31,114, 60% minority students
- 62 bachelor's, 49 master's and 24 doctoral degree programs
- Three campuses
- Eight Colleges: Architecture, Business, Education and Human Development, Engineering, Liberal and Fine Arts, Public Policy, Sciences, and Honors

Engineering at UTSA

- Four Departments: Biomedical; Civil & Environmental; Electrical & Computer; Mechanical. Faculty: 84
- 2,713 students enrolled in Fall 2011 versus 1,020 students in Fall 2000
- Fall 2011:
  - Undergraduate: 2,334
  - Master's: 259
  - Doctoral: 120



College of Engineering
Retention/Graduation Rates as of Fall 2010

- **1-year retention ~ 71.1%**
- **2-year retention ~ 57.3%**
- **3-year retention ~ 51.9%**
- **6-year graduation (Cohort 2003) 29.3%**
- **6-year graduation (Cohort 2004) 25.0%**
- **6-year graduation (Cohort 2005) 21.8%**
- **Our goal for 6-year graduation (2016) 55%**

(mandated by the State of Texas)

JITM COHORT RETENTION
As of Spring 2011

- 38% of Fall 2009 Participants were still enrolled in Engineering.
  - Compared to 33.9% College of Engineering
- 76% of Fall 2010 Participants were still enrolled in Engineering.
  - Compared to 55.4% College of Engineering
- 91% of Fall 2011 Participants were still enrolled in Engineering.
  - Compared to 72.7% College of Engineering

Math Placement Before and After JITM (beginning Fall 2008) at UTSA

Math Level	F 06	F 07	F 08	F 09	F 10
Remedial Math (not college-level math)	18%	17%	15%	9% (not accepted into COE)	11% (not accepted into COE)
College Algebra*	56%	39%	38%	48%	43%
Pre-Calculus*	6%	19%	18%	35%	19%
Calculus I**	11%	17%	17%	9%	17%
Calculus II**	9%	8%	10%	NA	7%
Calculus III *Pre-EGR admit status **Admitted to COE	NA	NA	2%	NA	3%

JITM Course*

Text

- Gilat, Amos, MATLAB, An Introduction with Application, 3rd Ed., Wiley, 2008
- Course & Lab Notes for EGR 101, Introductory Mathematics for Engineering Applications, Wright State University (on Blackboard)
- Req'd reading for Freshman Seminar – The Devil's Highway
- Landis, Studying Engineering, 3rd Ed., Discovery Press, 2007

Class

- 3-50 Minutes Lectures per Week
- 1-50 Minutes Laboratory per Week

Grading

• 2-Midterms	30%
• Lab Reports	10%
• Quizzes, Class Participation and Attendance	10%
• Homework	10%
• Learning Communities Supplement	15%
• Final Exam	25%

*Students earn 3 social & behavioral science credits—it is a Core Curriculum class

JITM Course Content

- Algebraic manipulation of engineering equations (linear and quadratic)
- Trigonometry
- Vectors and complex numbers
- Sinusoids and harmonic signals
- Systems of equations and matrices
- Differentiation, integration, differential equations
- Introduction to MATLAB

Laboratory Demonstration Assignments

1. Application of Algebra in Engineering
2. One-Link and Two-Link Robot Arms
3. Properties and Manipulations of Sinusoids
4. Two-Loop Circuit Applications of Systems of Equations
5. Freefall Application of the Derivative
6. Spring Work Application of the Integral
7. Leaking Bucket Application of a 1st order ODE
8. Spring-Mass Application of a 2nd order ODE

Student Survey Feedback

Fall 2011 JITM Cohort Students believe that JITM:
*out of 23 students

Survey Question	Strongly Agree	Agree
1. Increased their motivation to study engineering	3	10
2. Increased their chances of success in engineering	4	8
3. Increased their motivation to study math	4	7
4. Increased their chances of success in future math courses	7	5
5. Homework problems aided their understanding of lecture material	1	10
6. Lab sections aided their understanding of lecture material	1	10
7. Application of MATLAB was a valuable component of this course	3	3

Student Survey Feedback cont.

Spring 2012 JITM Cohort Students believe that JITM:

*out of 8 students

Survey Question	Strongly Agree	Agree
1. Increased their motivation to study engineering	3	3
2. Increased their chances of success in engineering	2	5
3. Increased their motivation to study math	7	
4. Increased their chances of success in future math courses	1	5
5. Homework problems aided their understanding of lecture material		7
6. Lab sections aided their understanding of lecture material	1	5
7. Application of MATLAB was a valuable component of this course		4

Student Survey Feedback cont.

- Fall cohort “strongly agreed” that review/tutoring sessions with the peer group leader were valuable. There was no peer mentor for the Spring Semester.
- Both cohorts “agreed” or “strongly agreed” that they were able to complete the requirements of both the Just in Time Math component and the Freshman Seminar component to their satisfaction.

Outreach/Marketing Efforts

- Presentations about JITM to Pre-Calculus classes
- Phone and email outreach to high school math and science department heads
- Presentations to high school math & science classes
- Posting flyers on bulletin boards around campus
- Attending Freshmen Orientation
- Work closely with advisors to ensure qualified students

Grant Funding

- Grant from Wright State University provides for 1 instructor and 1 TA for each academic year for JITM.
- UTSA has received 2 other grants from the UT System and the U.S. Dept of Education that provide funding for revamping EGR curriculum, which includes JITM and other new engineering curriculum developments.
- Grants from UT System and U.S. Dept of Education provide additional resources—mentors, program specialist, administrative costs, and stipends to students that help to cover the cost of tuition if a "C" or better is earned, etc. (Stipend amounts vary from semester to semester--$300, $1,000, and up to $2,000.)

Pros and Cons: Just in Time Math

- JITM is helping students to advance more quickly through Engineering curriculum.
- Only students who have passed Precalculus are eligible.
- JITM is housed in Learning Communities (Core Curriculum) and only freshman students w/30 credit hrs or less are allowed to register for it, which limits the pool of potential students.
- So far small sample sizes have made it difficult to make statistically significant generalizations about improved retention rates.
- UTSA COE Department Chairs want solid statistical evidence based on UTSA students' results that demonstrates success before JITM is accepted into COE curriculum.

Summary

- As of Summer 2012, just one academic advisor screens and registers all JITM students. This helps eliminate registration of improperly math-qualified students and increase retention of JITM students in our College of Engineering.
- JITM and other curricular modifications appear to improve the first year retention rates among engineering students who are not initially Calculus ready.
- We hope to have larger enrollments in Fall 2012 and Spring 2013 from which to evaluate program success.
- Please contact Dr. Mehdi Shadaram if you have technical questions about our program: mehdi.shadaram@utsa.edu, 210-458-4431.